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Best Demonstrated Available Technology (BDAT) Background Document for Stripping Still Tails from the Production of Methyl Ethyl Pyridines K026

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This background document provides the Agency's technical support and rationale for the development of treatment standards for the constituents to be regulated for the above-mentioned wastes.

This document also provides waste characterization data that serve as a basis for determining whether a variance from the treatment standard may be warrantec for a particular type of K026 that is more difficult to treat than the wastes on which the K026 treatment standards are based.

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FINAL

BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

BACKGROUND DOCUMENT

FOR

STRIPPING STILL TAILS FROM THE PRODUCTION OF METHYL ETHYL PYRIDINES

K026

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1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA or Agency) is establishing best demonstrated available technology (BDAT) treatment standards for the listed hazardous waste identified in Title 40, Code of Federal Regulations, Section 261.32 (40 CFR 261.32) as K026, stripping still tails from the production of methyl ethyl pyridines. These BDAT treatment standards are being established in accordance with the amendments to the Resource Conservation and Recovery Act (RCRA) of 1976, enacted by the Hazardous and Solid Waste Amendments (HSWA) of November 8, 1984. BDAT treatment standards will be effective no later than May 8, 1990, and on or after the effective date, compliance with these BDAT treatment standards will be a prerequisite under 40 CFR Part 268 for placement of the waste in land disposal units.

This background document provides the Agency's rationale and technical support for developing treatment standards for K026. The document also provides waste characterization data that serve as a basis for determining whether a variance from the treatment standard may be warranted for a particular type of K026 that is more difficult to treat than the wastes on which the K026 treatment standards are based.

The Agency's legal authority and promulgated methodology for establishing treatment standards and the petition process necessary for requesting a variance from the treatment standards are summarized in EPA's Methodology for Developing BDAT Treatment Standards (Reference 1).

Under 40 CFR 261.32, wastes identified as K026 are listed as stripping still tails from the production of methyl ethyl pyridines. The four-digit Standard Industrial Classification (SIC) code associated with the production of methyl ethyl pyridine is 2869 (Industrial Organic Chemicals: not elsewhere classified). The Agency is not aware of any domestic facilities that generate K026.

The Agency is establishing treatment standards for nonwastewater and wastewater forms of K026. To determine the applicability of the treatment

standards, wastewaters are defined as wastes containing less than 1% (weight basis) total suspended solids[1] (TSS) and less than 1% (weight basis) total organic carbon (TOC). Wastes not meeting this definition are classified as nonwastewaters and must comply with nonwastewater treatment standards.

EPA is establishing a method of treatment as the treatment standard for nonwastewater and wastewater forms of K026. The Agency is establishing this treatment standard because it is uncertain as to what constituents are present in K026, due to insufficient characterization data for K026. This uncertainty precludes the selection of appropriate BDAT List constituents for regulation, as explained in Section 6.0 of this document. The treatment standards for nonwastewater and wastewater forms of K026 are shown in Table 1-1.

Although the Agency is not aware of any facilities that generate K026, the Agency believes that treatment standards should be established for the following reasons: (1) a facility intending to manufacture methyl ethyl pyridines in the future, and generating stripping still tails as a result, would be forced to apply for a variance from the treatment standard (40 CFR 268.44); and (2) a facility disposing of K026 from past methyl ethyl pyridines manufacturing operations as part of a corrective action would also be forced to apply for a variance from the treatment standard.

This background document presents waste-specific information on the number and locations of facilities that may be affected by the land disposal restrictions for K026, the processes generating this waste, the waste characterization data, the technologies used to treat the waste (or similar wastes, if any), and the treatment performance data which support the establishment of treatment standards (Sections 2.0-4.0). This document also

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[1]The term "total suspended solids" (TSS) clarifies EPA's previously used terminology of "total solids" and "filterable solids." Specifically, total suspended solids is measured by Method 209C (total suspended solids dried at 103-105°C) in Standard Methods for the Examination of Water and Wastewater, Sixteenth Edition (Reference 2).

explains how EPA determined BDAT and treatment standards for K026 (Sections 5.0-6.0).

Table 1-1

BDAT TREATMENT STANDARDS FOR K026

NONWASTEWATERS AND WASTEWATERS

INCINERATION[1] AS A METHOD OF TREATMENT

[1]Incineration must be conducted in accordance with the technical requirements of 40 CFR Part 264 or Part 265 Subpart O.

2.0 INDUSTRY AFFECTED AND WASTE CHARACTERIZATION

This section describes the industries that may be affected by the land disposal restrictions for K026, the processes generating the waste, and the available waste characterization data.

2.1 Industry Affected and Process Description

K026 is defined as stripping still tails from the production of methyl ethyl pyridine (MEP). A search of available data indicates that MEP is no longer produced domestically (Reference 3).

MEP is among the pyridine bases that are produced commercially by synthesis rather than by isolation from coal tar. Figure 2-1 includes a generic process flow diagram for MEP production. Acetaldehyde and sulfuric acid are reacted to form crude paraldehyde that can be used to produce MEP or can be sent on for refinement. To produce MEP, the crude paraldehyde is preheated and reacted with ammonia acetate in the presence of an aluminum oxide, aluminum fluoride, or cobalt chloride catalyst. The resulting product stream is then transferred to an ammonia stripping still for ammonia recovery, and then transferred to a decanter. The MEP layer is further refined in a batch still. Residue from the decanter is processed in a water stripping still. The stripping still tails comprise the listed waste K026.

2.2 Waste Characterization

Available data (Reference 3) indicate the following general composition for K026:

Constituent	Concentration (%)
Paraldehyde	50
Pyridines	3
Picolines	3
Sulfuric Acid	6
Acetates	5
Water	33
Total:	100%

The only specific K026 characterization data that the Agency is aware of indicate that pyridine is present in the untreated waste at 32,500 ppm (Reference 3). Concencrations of other BDAT List constituents were not reported.

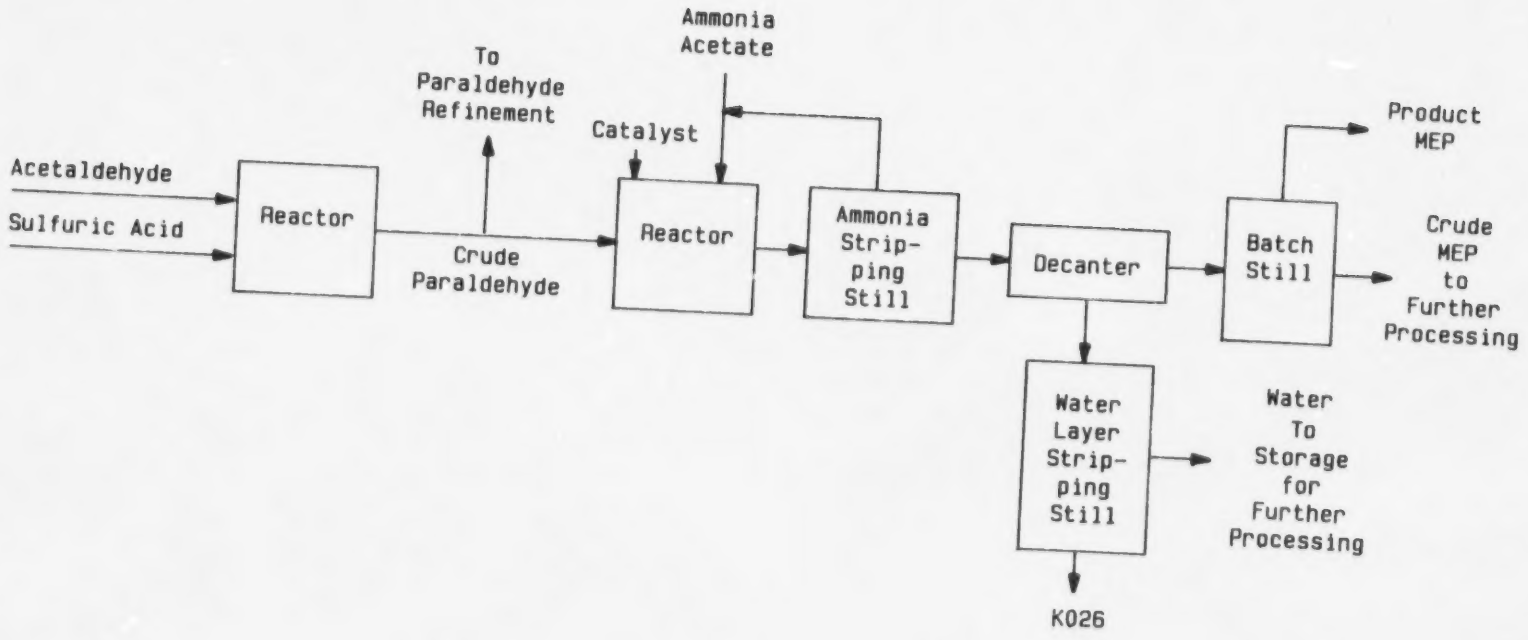

Figure 2-1. Flow Diagram for the Production of Methyl Ethyl Pyridine (MEP)

3.0 APPLICABLE AND DEMONSTRATED TREATMENT TECHNOLOGIES

This section discusses the technologies that are applicable for treatment of K026 nonwastewaters and wastewaters and determines which, if any, of the applicable technologies can be considered demonstrated for the purpose of establishing BDAT.

To be applicable, a technology must theoretically be usable to treat the waste in question or a waste that is similar in terms of parameters that affect treatment selection. (Detailed descriptions of technologies that are applicable to listed hazardous wastes are provided in EPA's Treatment Technology Background Document (Reference 4).) To be demonstrated, a technology must be employed in full-scale operation for treatment of the waste in question or a similar waste. Technologies available only at pilot- or bench-scale operations are not considered in identifying demonstrated technologies.

3.1 Applicable Treatment Technologies

The following subsections present applicable treatment technologies for nonwastewater and wastewater forms of K026.

3.1.1 Nonwastewaters

Since nonwastewater forms of K026 consist primarily of organic compounds (as shown in Section 2.0 of this document), applicable treatment technologies include those that destroy or reduce the total amount of various organic compounds in the waste. The Agency has identified the following treatment technologies as potentially applicable for these wastes: (1) incineration (fluidized-bed and rotary kiln); (2) solvent extraction followed by incineration or recycle of the extract; and (3) critical fluid extraction followed by recycle or incineration of the contaminated solvents. These treatment technologies were identified based on engineering judgment and current waste treatment practices for organic wastes.

Incineration. Incineration is a destruction technology in which energy, in the form of heat, is transferred to the waste to destabilize chemical bonds and destroy organic constituents. In a fluidized-bed incinerator, waste is injected into the fluidized-bed material (generally sand and/or incinerator ash), where it is heated to its ignition temperature. Heat energy from the combustion reactions is then transferred back to the fluidized-bed. Ash is removed periodically during operation and during bed change-outs.

In a rotary kiln incinerator, wastes are fed into the elevated end of the kiln, and the rotation of the kiln mixes the waste with hot gases to heat the waste to its ignition temperature. Ash is removed from the lower end of the kiln. Combustion gases from the kiln enter the afterburner for complete destruction of organic waste constituents. Other wastes may also be injected into the afterburner.

Combustion gases from the fluidized-bed or kiln afterburner are then fed to a scrubber system for cooling and removal of entrained particulates and acid gases, if present. In general, two residuals are generated by these incineration processes: ash and scrubber water.

Solvent Extraction. Solvent extraction is a separation technology in which organics are removed from the waste due to greater constituent solubility in the solvent phase than in the waste phase. This technology results in the generation of two treatment residuals: a treated waste residual and an extract. The extract may be recycled or may be further treated by incineration.

Critical Fluid Extraction. Critical fluid extraction is a solvent extraction technology in which the solvent is brought to its critical state to aid in the extraction of organic constituents from the wastes. After the extraction step, the solvent (liquified gas at its critical state) is brought to its normal condition in the gaseous state and generates a small volume of extract that is concentrated in organic constituents. This technology results in the generation of two treatment residuals: a treated waste residual and an

extract. The extract may be recycled or may be further treated by incineration.

3.1.2 Wastewaters

Since wastewater forms of K026 may contain organic constituents at treatable concentrations, applicable technologies include those that destroy or reduce the total amount of various organic compounds in the waste. The Agency has identified the following treatment technologies as potentially applicable for treatment of K026 wastewaters: (1) incineration; (2) steam stripping; (3) biological treatment (including PACT® treatment); (4) carbon adsorption; and (5) solvent extraction.

Incineration. Incineration of wastewaters in a rotary kiln or fluidized-bed is identical to that for nonwastewaters described previously in this section. In addition, liquid injection incineration may also be an applicable technology for treatment of K026 wastewaters. In a liquid injection incinerator, liquid wastes are atomized and injected into the incinerator. Combustion gases from the incinerator are then fed to a scrubber system for cooling and removal of entrained particulates and acid gases, if present. In general, only wastes with low or negligible ash contents are amenable to liquid injection incineration. Therefore, the technology generally does not result in the generation of an ash residual.

Steam Stripping. Steam stripping is a separation technology in which organics are removed from the waste by volatilization through the application of heat. This technology results in the formation of two treatment residuals: a treated waste extract and a treated effluent. The treated waste extract and the treated effluent may require further treatment by incineration, and carbon adsorption or biological treatment, respectively.

Biological Treatment. Biological treatment is a destruction technology in which organic constituents in wastewaters are biodegraded. This technology results in the formation of two treatment residuals: a treated effluent and a waste biosludge. The treated effluent and the waste biosludge

may require further treatment for metals by chemical precipitation and stabilization, respectively.

PACT[R] treatment is the addition of powdered activated carbon to a biological treatment process. This technology results in the formation of two treatment residuals: a treated effluent and a waste biosludge. The treated effluent and the waste biosludge may require further treatment for metals by chemical precipitation and stabilization, respectively. In addition, the waste biosludge may require further treatment by incineration.

Carbon Adsorption. Carbon adsorption is a separation technology in which organic constituents in wastewaters are selectively adsorbed onto activated carbon. This technology results in the formation of two treatment residuals: a treated effluent and spent carbon. The treated effluent may require further treatment for metals by chemical precipitation. The spent carbon may require further treatment by incineration.

Solvent Extraction. Solvent extraction of wastewaters is identical to that for nonwastewaters described previously in this subsection.

3.2 Demonstrated Treatment Technologies

The Agency is not aware of any facilities that treat K026 nonwastewaters and wastewaters. Therefore, the Agency is not aware of any technologies that are specifically demonstrated for treatment of K026. However, incineration is demonstrated for similar wastes, as discussed in Section 4.0 of this document. Liquid-liquid extraction followed by steam stripping followed by activated carbon adsorption is demonstrated for K103/K104 wastewaters. However, the Agency could not determine whether these wastes are similar to K026 due to a lack of characterization data for K026. In addition, the performance of this treatment train depends on the specific constituents in the waste being treated. Because the Agency does is uncertain as to constituents are present in K026, the performance of this treatment train on K026 cannot be determined.

4.0 TREATMENT PERFORMANCE DATA

This section presents the treatment performance data that were used to support the establishment of treatment standards for nonwastewater and wastewater forms of K026.

The Agency does not have any treatment performance data for treatment of K026 nonwastewaters or wastewaters. However, the Agency does have performance data for similar wastes previously tested by incineration (rotary kiln or fluidized-bed incineration) for nonwastewaters. This technology was identified as applicable and demonstrated for treatment of these wastes, as discussed in Section 3.0.

4.1 Nonwastewaters

Previous incineration tests conducted by the Agency are listed in Table 4-1 at the end of this section. EPA examined the wastes incinerated in these tests to determine their similarity to K026 nonwastewaters. Specifically, EPA examined (1) whether the untested K026 is generated from a similar industry or processing step, and (2) whether the waste has similar waste characteristics affecting treatment performance as do the previously tested wastes.

Wastes included in Tests 3, 4, 5, 11, 12, 13, and 14 are generated by the organic chemicals industry. The wastes incinerated in these tests are similar to K026 in that they are all organic wastes. Like K026, wastes incinerated in Tests 3, 4, 5, 11, and 14 were generated by distillation or some other type of separation process. Of the wastes generated by a process similar to that generating K026, those incinerated in Tests 3, 4, and 14 contain nitrogenated compounds and are therefore most structurally similar to K026. (Due to insufficient K026 characterization data, the Agency was unable to determine which particular tested waste was most similar to K026.) Incineration was shown to provide substantial treatment for the wastes included in these tests, as evidenced by constituent concentrations in the ash and scrubber water residuals. These data are included in the Onsite Engineering

Reports for these tests (References 5, 6, 8). Because of these similarities, it is believed that treatment performance similar to that achieved for the wastes incinerated in Tests 3, 4, and 14 could be achieved for K026 nonwastewaters.

4.2 Wastewaters

For the same reasons discussed in Section 4.1 for K026 nonwastewaters, the Agency believes that treatment performance similar to that achieved for the wastes incinerated in Tests 3, 4, and 14 could be achieved for K026 wastewaters.

Table 4-1

WASTES TESTED BY INCINERATION AND SAMPLED BY EPA

Test Number	Waste Code(s)	Treatment Technology Used
1	K001 - Pentachlorophenol	Rotary kiln incineration
2	K001 - Creosote	Rotary kiln incineration
3	K011, K013, K014	Rotary kiln incineration
4	K019	Rotary kiln incineration
5	K024	Rotary kiln incineration
6	K037	Rotary kiln incineration
7	K048, K051	Fluidized-bed incineration
8	K087	Rotary kiln incineration
9	K101	Rotary kiln incineration
10	K102	Rotary kiln incineration
11	F024	Rotary kiln incineration
12	K015	Liquid injection incineration
13	D014, K016, P059*, U127*, and U192*	Rotary kiln incineration
14	U141*, U028*, P020*, U112*, U226*, U239*, U080*, U220*, U166*, U161*, and U188*	Rotary kiln incineration

*Commercial chemical products were used in these test burns as surrogates for these wastes.

5.0 IDENTIFICATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

This section presents the Agency's rationale for determining the best demonstrated available technology (BDAT) for K026 nonwastewaters and wastewaters.

To determine BDAT, the Agency examines all available treatment performance data on technologies that are identified as demonstrated for the waste of concern, or for a waste similar to the waste of concern, to evaluate whether one or more of the technologies performs significantly better than the others. If data are available for only one technology for treating a waste, then that technology is "best." When data are available for more than one treatment technology, the "best" performing treatment technology is determined by an analysis of variance (ANOVA) test. (The ANOVA test is discussed in EPA's Methodology for Developing BDAT Treatment Standards (Reference 1).)

The treatment technology that is found to perform best on a particular waste stream is then evaluated to determine whether it is "available." To be available, the technology must (1) be commercially available, and (2) provide "substantial" treatment of the waste, as determined through evaluation of treatment performance data that have been corrected for accuracy. In determining whether treatment is substantial, EPA may consider data on a treatment technology's performance on a waste similar to the waste in question, provided that the similar waste is at least as difficult to treat. If it is determined that the best performing treatment technology is not available, then the next best technology is evaluated to determine whether it is "available."

5.1 Review of Treatment Performance Data

The treatment performance data (presented in Section 4.0) for wastes determined to be similar to K026 nonwastewaters and wastewaters were reviewed and assessed to determine whether they represent operation of a well-designed and well-operated treatment system, whether sufficient analytical quality assurance/quality control measures were employed to ensure the

accuracy of the data, and whether the appropriate measures of performance were used to assess the performance of the particular treatment technology.

The treatment performance data and the design and operating data collected during BDAT incineration Tests 3, 4, and 14 (References 5, 6, and 8) were reviewed for the points described above. The appropriate measure of performance (total constituent concentration) was used to assess the treatment systems. Additionally, the Agency had no reason to believe that these treatment systems were not well-designed and well-operated, or that insufficient analytical quality assurance/quality control measures were employed in generating treatment performance data.

5.2 Available Treatment Technologies

The demonstrated technology for treatment of K026, incineration, is considered to be commercially available. This technology provides substantial treatment of the wastes incinerated in Tests 3, 4, and 14. Since these wastes are considered to be at least as difficult to treat as K026, the Agency believes that incineration will also provide substantial treatment of K026. Consequently, incineration is considered available for treatment of K026.

5.3 BDAT for K026

As discussed above, incineration has been determined to be demonstrated and available for treatment of nonwastewater and wastewater forms of K026. Because the Agency does not have treatment performance data for any other demonstrated and available technologies for treating K026 or similar wastes, incineration is considered to be the best. Therefore, the best demonstrated available technology (BDAT) for K026 has been determined to be incineration. Scrubber waters generated from the incineration of K026 nonwastewaters are considered to meet the treatment standard for K026 wastewaters and do not require further treatment (See 54 Federal Register 26630 (June 23, 1989)). In addition, this BDAT technology does not preclude a

facility from utilizing recycle or reuse operations in accordance with 40 CFR Part 261.

6.0 DETERMINATION OF BDAT TREATMENT STANDARDS

The Agency prefers, whenever possible, to set concentration-based treatment standards for listed wastes, so as not to limit the selection of those treatment technologies that may be used to achieve the BDAT treatment standards. In cases where concentration-based standards cannot be determined, EPA may choose to establish a method of treatment as the treatment standard.

Inherent in the establishment of concentration-based treatment standards is the selection of constituents for regulation. EPA considers several points in its selection of regulated constituents:

- How difficult a constituent is to treat, based on waste characteristics affecting treatment performance;
- How representative a constituent is of others in the waste, based on structural similarities; and
- How much of the constituent is present in the waste, based on concentration levels.

The Agency has limited characterization data for K026 and does not believe that using the above criteria, these data are sufficient for evaluating which constituents should be regulated in K026. EPA is uncertain whether other constituents, which may not be controlled by regulation of the BDAT List constituents quantified in K026, are present in K026. This uncertainty precludes the selection of appropriate BDAT List constituents for regulation. Accordingly, the Agency is establishing a method of treatment as the treatment standard for nonwastewater and wastewater forms of K026.

Incineration was determined to be BDAT for nonwastewater and wastewater forms of K026, as discussed in Section 5.0. Because incineration is a technology that is applicable to treatment of most organic constituents, it is particularly appropriate for treatment of K026, since the identities and physical properties of the waste constituents have not been fully identified. Accordingly, the Agency is establishing incineration as a method of treatment for nonwastewater and wastewater forms of K026.

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